

Examining User's Images by the Differences of the Awareness regarding Electrical Appliances

Toshihisa Doi* Toshiki Yamaoka *

** Faculty of Systems Engineering, Wakayama University
s115070@sys.wakayama-u.ac.jp*

Abstract: The purpose of this study is to examine differences of user's images and knowledge about electrical appliances. And the differences were examined by the differences of user's awareness and attitude to the electrical appliances. This paper shows the differences of the images about the appliances among three user groups. In addition, we decided that a mobile phone, a digital camera and a mobile music player were used in this study as an object. This study was conducted user classification, key graph and FCA, and examined user's images by the differences of the awareness to the electrical appliances. As a result, it is concluded that the differences and the characteristics of the images of each group were understood by the differences of the awareness. And, the relationship between users' appliances images and users' appliances awareness was understood. It seems that user who is interested in the appliances has positive images about appliances, and user who relies on other for operation of the appliances has negative and complex images about appliances, and user who does not use the appliances as much as unnecessary has convenient images about appliances.

Key words: *Cognitive of appliances images, Appliances Images, Appliances Awareness, Key Graph, Formal Concept Analysis.*

1. Introduction

The purpose of this study is to examine the differences between user's images and knowledge about the electrical appliances. It seems that grasping user's images by the differences of the awareness to the electrical appliances is useful design of appliances to each user with a different awareness to the electrical appliances. And the differences were examined by the differences of user's awareness and attitude to the appliances. First, users were divided into three groups from view point of the user's awareness to the appliances. And this paper shows differences of the images about the appliances among three user groups. In addition, we decided that surveyed appliances were a mobile phone, a digital camera and a mobile music player.

In this research, first of all, the questionnaire about user's image and awareness regarding the equipments was conducted. The questionnaire about the awareness was conducted to divide users into three groups of "Group-A", "Group-B" and "Group-C". The questionnaire about the images consisted of "Sentence Completion Test". Then, a text data was extracted by the questionnaire about the images. The text data was analyzed using "Key Graph" each group. And the relationship among words has been grasped. Accordingly, it is concluded that the

differences and the characteristics of the images of each group were understood by the differences of the awareness.

2. Questionnaires Survey

There were 26 test participants (age: 20~25, average age: 22, standard deviation: 1.5) who conducted the questionnaires survey.

2.1 Survey of User’s Awareness to Electrical Appliances

The survey about user’s awareness to electrical appliances was conducted by the questionnaires. These questions were performed for user classification. The questionnaire about awareness to appliances was consisted of 28 question items by 5-point scale. It is assumed an interest, an emotion and an opinion on the operation with awareness in this study. This question items are Table 2.1.

Table 2.1 Example of questionnaire about awareness regarding electrical appliances

Q1	I am a type to rely on the person the operation of electrical appliances.
Q2	I don’t use electrical appliance as much as unnecessary.
Q3	I would like to use many other functions of electrical appliances.
Q4	I am interested in electrical appliances.
Q5	I will give up, shortly after stumbling first by operation of equipments.

2.2 Survey of User’s Images regarding the Electrical Appliances

The survey about user’s images regarding the appliances was conducted by the questionnaires. These questions were performed to grasp the differences by user’s groups. The questionnaire about images was consisted of 24 question items by “Sentence Completion Test”. “Sentence Completion Test” is the method that users give an answer by text data. This question items are Table 2.2.

Table 2.2 Example of questionnaire about images regarding electrical appliances

Q1	An ideal mobile phone is ().
Q2	If mobile phone () because that is ().
Q3	Existence of a mobile phone is ().
Q4	A mobile phone is (). So ().
Q5	Form of a mobile phone is ().

3. Analysis

This analysis method was conducted to research the knowledge structure of different users of the attitude to a product in the study of the author [1].

3.1 User Classification and the Feature Grasp of User Groups

First, 26 test participants were divided into three groups from view point of the user’s awareness to electrical appliances. User classification used principal component analysis and cluster analysis. The data using these analyses were 12 question items about awareness to appliances. Selected 12 question items were the items that

can group the users. The basis of the items selection was a standard deviation, and the standard deviation of the selection items was 1 or more. Cluster analysis was conducted using adopted score by principal component analysis.

After the user classification, significant difference test of questionnaire items was conducted for grasping the feature each group. Since normality was not secured, Kruskal-Wallis test and Steel-Dwass test which were nonparametric techniques were used for significant difference test [2].

3.2 Analyze by Key Graph

Next, key graph was conducted for examining user's images each user group. Key Graph means the method which is able to grasp the frequently appearing words and the characteristic words from documents and utterances [3]. Then, the method shows the relationship among them for visualizing. Key graph used the text data about images regarding the appliances.

The text data was analyzed using key graph. As a result, the frequently appearing words and the characteristic words were extracted. And the relationship among words has been grasped.

3.3 Analyze by Formal Concept Analysis

After key graph, formal concept analysis (FCA) was used to understand an inclusive relationship and conceptual structure about the appliances images in each user group. FCA means the method which is able to grasp the structure and the inclusive relationship of words using a category matrix which consists of "Attribution" and "Object". In this case, the "Attribution" is characteristics of the "Object" [4, 5].

First, the category matrix was created using the frequently appearing words and the characteristic words extracted by key graph. If test subject answered the words extracted by key graph, numeric value of category matrix is "1". If test subject did not answer the words, numeric value of category matrix is "0". And, the "Attribution" was made the words extracted by key graph, the "Object" was made the test participants, and FCA was done.

4. Results

4.1 Results of Classification

The classification was conducted. The result appears in Table 4.1. Because the 4th principal component was "the eigenvalue = 1.19 > 1" and "the percentage of cumulative contribution rate = 61.79 = 60~80", the 1st ~4th principal component were adopted as a principal component. And, as a result of cluster analysis, test participants were classified by the principal component score up to the 4th principal component into Group-A, Group-B and Group-C. Group-A was 16 test participants, Group-B was 5 test participants and Group-C was 5 test participants.

Table 4.1 Results of principal component analysis

Principal component number	Eigenvalue	Contribution rate (%)	Cumulative contribution rate (%)
1	2.67	22.22	22.22
2	2.01	16.75	38.97
3	1.55	12.89	51.87
4	1.19	9.92	61.79
5	1.16	9.70	71.49

Next, Kruskal-Wallis test and Steel-Dwass test were conducted for grasping the feature each group. The result appears in Table 4.2. Because significant differences were seen in Q5 and Q6 with 5% level of significance, and significant differences were seen in Q15 and Q16 with 1% level of significance, Steel-Dwass test was conducted to these items. Q15 and Q16 of the result appear in Figure 4.1 and 4.2.

As results these analysis and test, it was understood that “Group A” is the group which is interested in the appliances, and “Group B” is the group which relies on others for operation of the appliances, and “Group C” is the group which doesn’t use the appliances as much as unnecessary.

Table 4.2 Results of Kruskal-Wallis test

	Q1	Q2	Q4	Q5	Q6	Q7	Q8	Q13	Q15	Q16	Q17	Q18
χ^2	3.005	2.846	5.530	5.351	8.753	9.119	3.539	.211	10.671	12.926	5.239	2.601
degrees of freedom	2	2	2	2	2	2	2	2	2	2	2	2
p	.223	.241	.063	.069 (*)	.013 (*)	.010	.170	.900	.005 (**)	.002 (**)	.073	.272

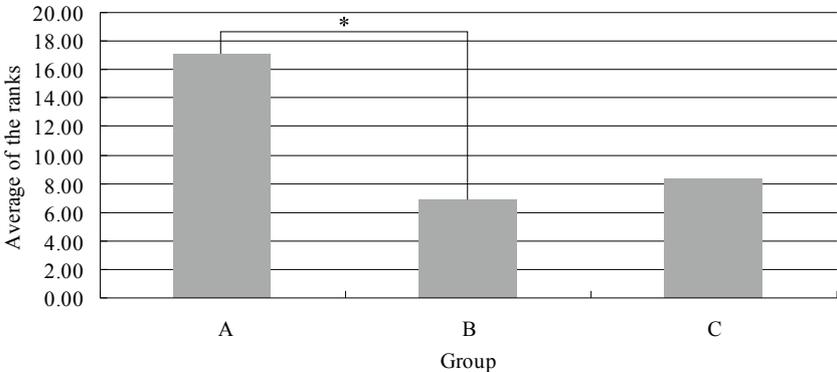


Figure 4.1 Average of the ranks in and result of Steel-Dwass test about Q15 (*:5% level of significance, **: 1% level of significance)

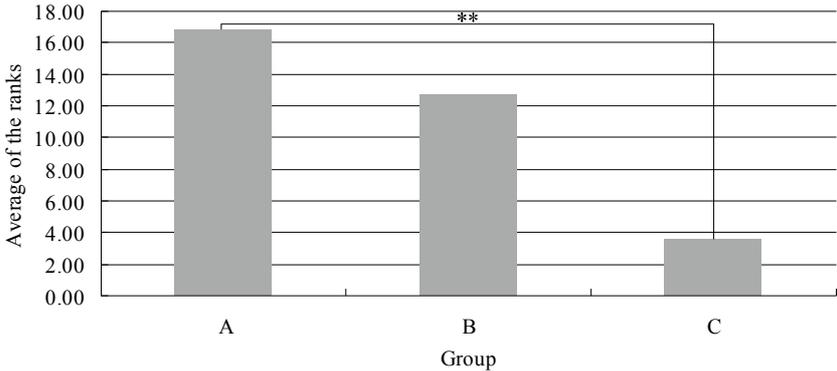


Figure 4.2 Average of the ranks and result of Steel-Dwasstest about Q16 (*:5% level of significance, **: 1% level of significance)

4.2 Results of Key Graph

As a part of result, Figure 4.3 (Group-A), Figure 4.4 (Group-B) and Figure 4.5 (Group-C) show the results of key graph about a mobile phone.

In Group-A, it was constituted focusing on words –function, convenience, charge, absent, strand, contact, demand--. And, words –battery, compact, cubed, phone— were seen that there was little frequency, and was characteristic. Accordingly, it is considered that participants of Group-A feels necessity of the mobile phone. In addition, the words which like square and simple form were appeared.

In Group-B, it was constituted focusing on words –messy, convenience, carry, retain--. And, various words about a problem and an ideal centering on “demand” were seen that there was little frequency, and was characteristic. Especially, negative words –cumber, complication, tiring, dislike-- were seen. Accordingly, it is considered that Group-B has negative images regarding mobile phone, and they are poor at using mobile phone.

In Group-C, it was constituted focusing on words –necessity, convenience, retain, good, messy--. And, various words about a problem and an ideal centering on “demand” were seen that there was little frequency, and was characteristic as well as Group-B. In addition, negative words –cumber, complication, tiring, dislike-- were seen. Accordingly, it is considered that Group-C thinks a mobile phone to be necessary, but they don’t use the appliances as much as unnecessary.

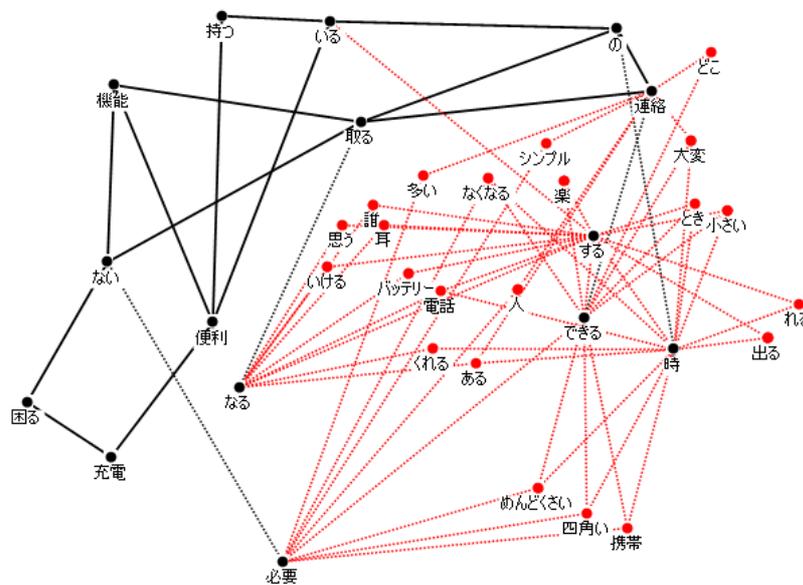


Figure 4.3 A result of key graph about a mobile phone (Group-A)

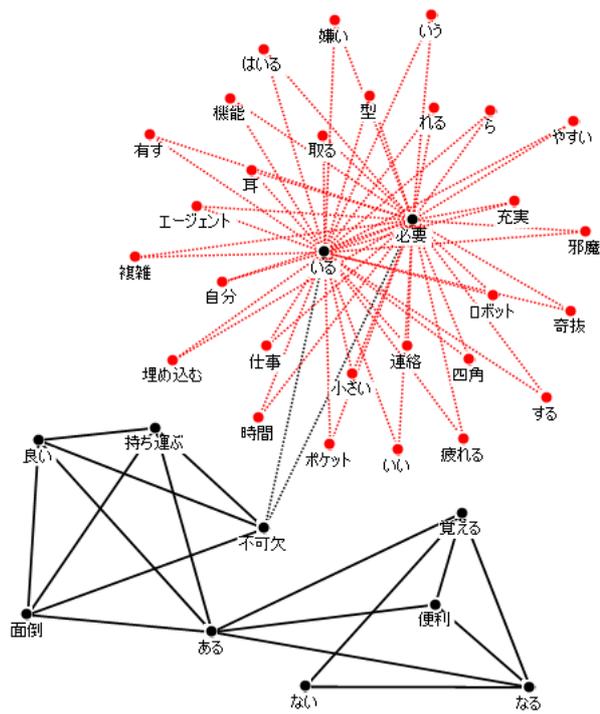


Figure 4.4 A result of key graph about a mobile phone (Group-B)

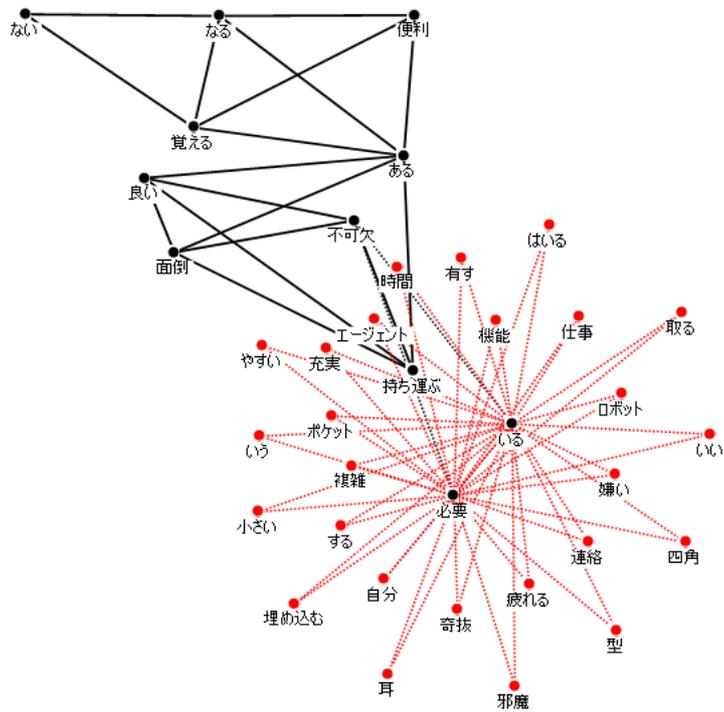


Figure 4.5 A result of key graph about a mobile phone (Group-C)

4.3 Results of Formal Concept Analysis (FCA)

As a part of result, Figure 4.6 (Group-A), Figure 4.7 (Group-B) and Figure 4.8 (Group-C) show the results of FCA about a mobile phone.

In Group-A, the concept of the word except “communication”, “necessity” and “complex” were about same.

In Group-B, the most general attribution was the words “convenience” and “necessity”. But, there were some participants who feel that the function of a mobile phone is complicated.

In Group-C, the most general attribution was the words “contact”, “use”, and “necessity”. And, there were participants who are answering as “convenient” in the participants who are answering as “necessity”.

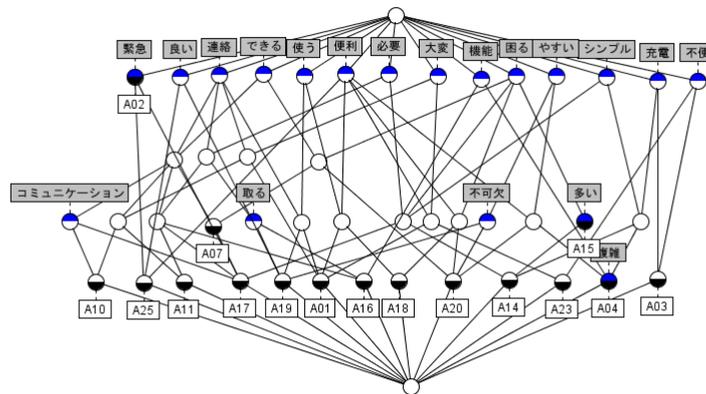


Figure 4.6 A result of FCA about a mobile phone (Group-A)

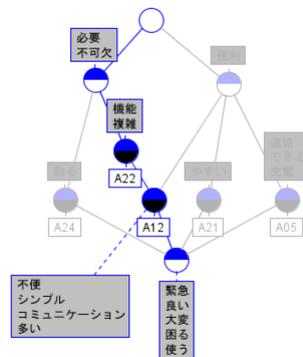


Figure 4.7 A result of FCA about a mobile phone (Group-B)

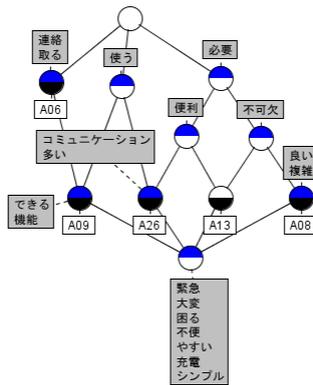


Figure 4.8 A result of FCA about a mobile phone (Group-C)

5. Discussion

The overall consideration of this paper is described to. This study was conducted user classification, key graph and FCA, and examined user's images by the differences of the awareness to the electrical appliances. As a result, users' images were grasped in each group with different awareness.

Group-A: The group which is interested in the appliances

It is considered that Group-A has positive images with the appliances and Group-A have felt necessity of the appliances. In addition, it is considered that they hope simple form about the appliances.

Group-B: The group which relies on others for operation of the appliances

Group-B is the group thought to be complex about the appliances, and they are poor at using the appliances. Accordingly, it is considered that Group-B has negative images with the appliances.

Group-C: The group which doesn't use the appliances as much as unnecessary

It is considered that Group-C thinks the appliances to be necessary and Group-C think to be convenient for the appliances. But, they don't use the appliances as much as unnecessary.

As above, users' images were grasped. And, the relationship between users' appliances images and awareness was understood. It seems that user who is interested in the appliances has positive images about them, and user who relies on other for operation of the appliances has negative and complex images about them, and user who does not use the appliances as much as unnecessary has convenient images about them.

In addition, users requirement were extracted from this process of examining users' images in the appliances (a mobile phone, a digital camera and a mobile music player). It seems that users want using a simple function and a simple form.

6. Summary

This paper described to examining the differences of user's images and awareness to the electrical appliances. And, this study was grasped the relationship between users' appliances images and awareness was understood. As a result, it seems that we got 7th findings;

- A user who is interested in the appliances has positive images.
- A user who relies on other for operation of the appliances has negative images.
- A user who relies on other for operation of the appliances thought to be complex about them.
- A user who does not use the appliances as much as unnecessary thought to be convenient about them.
- Even if a user thought to be convenient about the appliances, there is a user who does not use them as much as unnecessary.
- Some user hopes using appliances of a simple function.
- Some user hopes using appliances of a simple form.

7. Reference

- [1] Yukio Osawa. (2003) Chance Discovery Data Analysis. *Tokyo Denki University Press*.
- [2] Hiroyasu Nagata. (2004) Qualitative Analysis Based on Formal Concept. *The Japan Society for Socio-Information Studies*, vol.14, no.1, pp 19-37.
- [3] Osamu Suzuki. (2006) Tutorial: Formal Concept Analysis and its applications [Online PDF]. Available at <http://zemi-os.adin.hamamatsu-u.ac.jp/fca/2006_11_fcaintro.pdf> [Accessed 27 April 2009]
- [4] Toshihisa Doi, Masatoshi Rin, Sayoko Tominaga and Toshiki Yamaoka. (2008) Consideration concerning relation between attitude to user's electrical appliances and the knowledge structures. *The collection of the Japan Ergonomics Society Kansai branch convention resumes*, pp 141-144.
- [5] Yasushi Nagata and Mitihiko Yoshida. (1997) The Basics of Statistical Multiple Comparison Method. *Scientist Press*.